Leslie Hodson, particle physicist and pioneer in the study of cosmic rays

1925 – 2010

Obituary and Bibliography

Leslie Hodson

Leslie Hodson was an experimental particle physicist who developed cloud and spark chamber techniques in the study of cosmic rays. Yet, despite his achievements in the field, he believed that the most useful thing he did was prevent asbestos from being used in the construction of the new campus at the University of Leeds in the 1960s.

Albert Leslie Hodson was born an only child in 1925 to tenant farmer parents at Fishlake, on the floodplain of the River Don, north-east of Doncaster. He was an only child, but had an extended family of aunts, uncles and cousins, all living in the near vicinity. He first attended Fishlake Endowed School, a two-room school where children of all levels were taught together. He failed his 11-plus but despite this, his father found him a place at Thorne grammar school, at a cost of three guineas a term, and his parents managed to scrimp enough to pay for it.

In 1943, Leslie's higher school certificate results were good enough for a county scholarship. He decided to study physics at Manchester University, having heard from a cousin that Professor P.M. Blackett was working there. Leslie had never heard of Blackett, but what had impressed his cousin was good enough for him. After two years he was recruited to the Royal Aircraft Establishment at Farnborough, but the week he was due to report he developed mumps. The war ended, and instead of going to Farnborough he completed his third year at Manchester.

During this year he devised his own project on the optics of sodium vapour using equipment of his own construction. Blackett immediately offered him a PhD researching cosmic rays.

He studied altitude effects in cosmic ray air-showers. This involved building his own instruments, including making Geiger counters from glass tubing and fitting them into bomb casing. This instrument package was loaded into the bomb bay of a Mosquito and flown to over 30,000ft (9.1km). The solution to a problem in the use of Geiger tubes led to his first scientific paper at only 23.

The mainstay of Blackett's cosmic ray research was the cloud chamber. He had received the Nobel Prize in 1948 for his work on triggering chambers using external Geiger counters and the subsequent discovery of the positron. In a flash of inspiration, Leslie realised that the trigger could be generated from the gas within the chamber itself. Despite others' doubts, he persuaded Blackett to support him. He also built the electronics to automatically control the chamber, secretly, out of hours, protecting it from Blacketts critical view by a cloth cover and only revealing its existence when it was fully working. As a result of all this work, Manchester appointed him assistant lecturer.

In 1951 he became a research associate at Princeton. The Princeton cosmic ray group was running cloud chambers at Echo Lake in the Rockies at an altitude of 3,230m. They were studying the so-called V-particles, recently discovered at Manchester. All the images were photographed and, on the last reel of film they discovered a new particle, now known as the K+, one of the kaons. Their measurement of the particle's rest mass was within two per cent of the currently accepted figure.

Leslie returned to Britain in 1954 to take up a lectureship at the University of Leeds. He designed and built the world's largest cloud chamber, having taught himself the required skills, and made deft use of local industry in its construction.

The mid-Sixties were a period of expansion in the universities, and Leeds had chosen Chamberlin, Powell and Bon to design a new campus. Leslie worked with them, providing a link between the architectural vision and the scientists and educators who were to use the buildings. The design called for asbestos cement panels as duct covers. Leslie had read in the scientific press that asbestos was hazardous and fought against its use. The University banned the use of asbestos in all future buildings, probably the first time this was done in Britain.

By the end of the 1960s the physics department was installed in its elegant modernist buildings and Leslie could turn once again to research. The quark model had been proposed by Murray Gell-Mann and George Zweig in 1964 and physicists were looking for evidence of them. Using the Leeds cloud chamber, he and his team searched for free quarks in the cores of cosmic ray air-showers. Quarks were predicted to have 1/3 or 2/3 the charge of an electron and this would give rise to 1/9 or 4/9 the ionisation along their path. This would be clearly visible by the thickness of

the tracks produced in a cloud chamber. However, the cores of cosmic ray air-showers have vast numbers of particle tracks, all of which had to be examined in detail. It was painstaking work and at the end of it Leslie and his team came to the conclusion that there was no evidence that free quarks existed.

The visual and photographic techniques Leslie used were both labour-intensive and expensive and, towards the end of his career, this became a seriously limiting factor. More recent experiments replaced the cameras with electronic techniques using charge read-out from vast numbers of wires and strips. However, now, in an era where high-resolution digital photography is cheap and the computer power to process it ubiquitous, a return to visual and photographic techniques offers simplicity and elegance, and a further potential reduction in cost.

Leslie was a Methodist and a teetotaller. He had a huge range of interests, including philosophy, genealogy, planning, architecture, music, education and modern art. He was a founder member of his local residents' association and fought inappropriate developments. He was also a keen gardener, winning prizes at his local horticultural society for fruit and vegetables, including greenhouse-grown peaches.

Albert Leslie Hodson, scientist: born Fishlake, West Riding of Yorkshire, 15 July 1925; married 1958 Joyce Wicks (three sons); died Leeds, West Yorkshire, 1 March 2010.

A version of this obituary first appeared in "The Independent", London, 27th May 2010.
I would like to thank Mugdha Joshi for considerable help in preparing the bibliography and the staff of the Independent for editorial assistance.

John McMillan

Department of Physics and Astronomy,
The University of Sheffield, Sheffield, South Yorkshire, S3 7RH, Great Britain.

j.e.mcmillan@sheffield.ac.uk

Publications

[1] A.L. Hodson. Reduction of 'insensitive time' in Geiger-Müller counters. *Journal of Scientific Instruments*, 25(1):11–13, 1948.

[2] A. L. Hodson and A. Loria. Control of a Wilson cloud chamber by means of an internal counter. *Il Nuovo Cimento*, 6:369–370, 1949.

[3] A. L. Hodson, A. Loria, and N. V. Ryder. The control of a Wilson cloud chamber by means of an internal counter. *Philosophical Magazine*, 41(319):826 – 837, 1950.

[4] A. L. Hodson. The temperature effect of extensive air showers. *Proceedings of the Physical Society. Section A*, 64(384):1061–1064, 1951.

[5] A. L. Hodson. The altitude variation of penetrating showers. *Proceedings of the Physical Society. Section A*, 65(393):702–708, 1952.

[6] A. L. Hodson. Some aspects of the altitude variation of extensive air showers. *Proceedings of the Physical Society. Section A*, 66(397):49–64, 1953.

[7] A. L. Hodson. Penetrating particles in extensive air showers. *Proceedings of the Physical Society. Section A*, 66(1):65–72, 1953.

[8] J. Ballam, D.R. Harris, A.L. Hodson, R.R. Rau, G.T. Reynolds, and M. Vidale. Magnetic field cloud chamber for studying nuclear interactions in the cosmic radiation. I. Equipment. (Abstract). *Physical Review*, 90(2):369, 1953.

[9] R.R. Rau, M. Vidale, G.T. Reynolds, D.R. Harris, A.L. Hodson, and J. Ballam. Magnetic field cloud chamber for studying nuclear interactions in the cosmic radiation. II. Preliminary results. (Abstract). *Physical Review*, 90(2):369, 1953.

[10] J. Ballam, D.R. Harris, A.L. Hodson, R.R. Rau, G.T. Reynolds, S.B. Treiman, and M.L. Vidale. Momenta of V^0 particles. (Abstract). *Physical Review*, 91(2):446, 1953.

[11] J. Ballam, D.R. Harris, A.L. Hodson, R.R. Rau, G.T. Reynolds, S.B. Treiman, and M. Vidale. Kinetic energies of V_1^0 particles. *Physical Review*, 91(4):1019–1020, 1953.

[12] D.R. Harris and A.L. Hodson. Production of V^0 particles in copper. (Abstract). *Physical Review*, 95(2):661, 1954.

[13] W.H. Arnold, J. Ballam, H. Gursky, A.L. Hodson, R.R. Rau, G.T. Reynolds, and S.B. Treiman. Unstable cosmic-ray particles observed in a double cloud chamber arrangement. (Abstract). *Physical Review*, 96(3):853, 1954.

[14] A.L. Hodson, J. Ballam, W.H. Arnold, D.R. Harris, R.R. Rau, G.T. Reynolds, and S.B. Treiman. Cloud-chamber evidence for a charged counterpart of the θ^0 particle. *Physical Review*, 96(4):1089–1095, 1954.

[15] W.H. Arnold, J. Ballam, A.L. Hodson, R.R. Rau, G.T. Reynolds, S.B. Treiman, and V.A. Van Lint. Analysis of charged V events. (Abstract). *Physical Review*, 98(1):275–276, 1955.

[16] J. Ballam, A.L. Hodson, and G.T. Reynolds. Observations on S particles. *Physical Review*, 99(3):1038, 1955.

[17] S.B. Treiman, G.T. Reynolds, and A.L. Hodson. Angular correlation effects in unstable particle decay. *Physical Review*, 97(1):244–245, 1955.

[18] J. Ballam, A.L. Hodson, W. Martin, R.R. Rau, G.T. Reynolds, and S.B. Treiman. Orientation of planes in double V^0 decay events. *Physical Review*, 97(1):245–246, 1955.

[19] W.H. Arnold, J. Ballam, A.L. Hodson, G.K. Lindeberg, R.R. Rau, G.T. Reynolds, and S.B. Treiman. Recent cloud chamber results on masses of heavy mesons and hyperons. *Il Nuovo Cimento*, 4, Supp.2:559–564, 1956.

[20] A.L. Hodson, T.C. Bacon, and B.R. Pullan. A large Wilson cloud chamber and its application to ionization calorimetry work. In *9th International Cosmic Ray Conference, London*, volume 2, pages 1082–1084, 1965.

[21] D.A. Briggs and A.L. Hodson. Particle counting in locally produced showers using vidicon television techniques. In *9th International Cosmic Ray Conference, London*, volume 2, pages 1105–1107, 1965.

[22] W.E. Hazen, A.L. Hodson, and D.F. Winterstein. A cosmic-ray quark search with a large cloud chamber. In *12th International Cosmic Ray Conference, Hobart*, volume 3, page 1161, 1971.

[23] W.E. Hazen, A.L. Hodson, D. Winterstein, and O. Keller. Search for e/3 quarks in cosmic rays with the Leeds cloud chamber. In *13th International Cosmic Ray Conference, Denver*, volume 3, pages 2087–2089, 1973.

[24] W.E. Hazen, A.L. Hodson, D. Winterstein, and O. Keller. Transverse momenta from an air-shower study. In *13th International Cosmic Ray Conference, Denver*, volume 3, pages 2124–2125, 1973.

[25] D.F. Winterstein, W. E. Hazen, A. L. Hodson, B. Green, and J. Kass. Search for quarks in dense central region of air showers. (Abstract). *Bulletin of the American Physical Society*, 19(4):583, 1974.

[26] W. E. Hazen, A. L. Hodson, B. Green, J. Kass, and D.F. Winterstein. Search for Mandelas with Leeds cloud chamber. (Abstract). *Bulletin of the American Physical Society*, 19(4):583, 1974.

[27] O. Keller, W. E. Hazen, D.F. Winterstein, and A. L. Hodson. Cloud chamber evidence for large $p_\perp$ in cosmic-ray air showers. (Abstract). *Bulletin of the American Physical Society*, 19(4):447, 1974.

[28] W.E. Hazen, J.R. Kass, B.R. Green, and A.L. Hodson. A cloud chamber study of large cosmic ray bursts from an absorber at sea level. (Abstract). In *14th International Cosmic Ray Conference, München*, volume 7, page 2461, 1975.

[29] W.E. Hazen, A.L. Hodson, J.R. Kass, B.R. Green, and P.G. Lloyd. A search for e/3 quarks using the Leeds cloud chamber. (Abstract). In *14th International Cosmic Ray Conference, München*, volume 7, page 2473, 1975.

[30] W.E. Hazen, B.R. Green, A.L. Hodson, and J.R. Kass. A search for precursors to extensive air showers. (Abstract). In *14th International Cosmic Ray Conference, München*, volume 7, page 2485, 1975.

[31] W.E. Hazen, A.L. Hodson, O.A. Keller, B.R. Green, and J.R. Kass. Observations of core structure in extensive air showers of 10^{15}–10^{16} eV. In *14th International Cosmic Ray Conference, München*, volume 8, pages 2984–2988, 1975.

[32] A.L. Hodson. Possible suppression of Čerenkov emission in closely-collimated jets. An explanation of the 'magnetic monopole' event? In *14th International Cosmic Ray Conference, München*, volume 12, pages 4065–4067, 1975.

[33] W.E. Hazen, A.L. Hodson, D.F. Winterstein, B.R. Green, J.R. Kass, and O.A. Keller. Search for $\frac{1}{3}e$ quarks in cosmic rays with the Leeds cloud chamber. *Nuclear Physics B*, 95(2):189–196, 1975.

[34] W.E. Hazen, B.R. Green, A.L. Hodson, and J.R. Kass. A search for precursors to extensive air showers. *Nuclear Physics B*, 96:401–406, 1975.

[35] A.L. Hodson, J.M. Foster, B.R. Green, and R.M. Bull. A 35 sq m array of current-limited spark chambers for the investigation of extensive air shower cores. In *15th International Cosmic Ray Conference, Plovdiv*, volume 12, pages 160–165, 1978.

[36] J.M. Foster, A.L. Hodson, B.R. Green, W.E. Hazen, A.Z. Hendel, and R.M. Bull. Observations of extensive air shower cores in the energy range 10^{14}–10^{16} eV. In *15th International Cosmic Ray Conference, Plovdiv*, volume 12, pages 50–55, 1978.

[37] W. E. Hazen, A. Z. Hendel, J. F. Foster, B. A. Green, A. L. Hodson, and R. Bull. High p_t cross section from multiple core rates in air showers. *AIP Conference Proceedings*, 49(1):31–39, 1979.

[38] M.R. Porter and A.L. Hodson. A study of the air-shower response of current-limited spark chambers and scintillators. (Abstract). In *16th International Cosmic Ray Conference, Kyoto*, volume 8, page 227, 1979.

[39] W.L. Hazen, A.Z. Hendel, J.M. Foster, B.R. Green, A.L. Hodson, M.R. Porter, and R.M. Bull. Air shower subcores in air and high p_t. In *16th International Cosmic Ray Conference, Kyoto*, volume 8, pages 230–235, 1979.

[40] B.R. Green, A. Ash, and A.L. Hodson. Computer simulations of extensive air shower cores of energy 10^{14}–10^{16} eV. In *16th International Cosmic Ray Conference, Kyoto*, volume 13, pages 217–222, 1979.

[41] B.R. Green and A.L. Hodson. A Monte-Carlo study of detection methods for extensive air shower cores falling within a given area. In *16th International Cosmic Ray Conference, Kyoto*, volume 13, pages 211–216, 1979.

[42] A.M. Hillas, J.M. Foster, B.R. Green, A.L. Hodson, W.E. Hazen, and A.Z. Hendel. EM transition effect for air shower subcores. In *16th International Cosmic Ray Conference, Kyoto*, volume 8, pages 236–239, 1979.

[43] R.M. Porter, L.A. Hodson, and R.M. Bull. A study of the air-shower response of current-limited spark chambers. In *17th International Cosmic Ray Conference, Paris*, volume 11, pages 365–368, 1981.

[44] W.E. Hazen, A.G. Ash, J.M. Foster, A.L. Hodson, and M.R. Porter. Simulation studies of uncertainties in air shower subcore determination of p_t. In *17th International Cosmic Ray Conference, Paris*, volume 5, page 148, 1981.

[45] W.E. Hazen, A.Z. Hendel, A.G. Ash, J.M. Foster, A.L. Hodson, M.R. Porter, and R.M. Bull. Subcore observations and high p_t. In *17th International Cosmic Ray Conference, Paris*, volume 5, pages 144–147, 1981.

[46] A.L. Hodson, M.R. Porter, and R.M. Bull. A new search for free e/3 quarks from $\sim 10^{15}$–$5 \cdot 10^{15}$ eV interactions. (Abstract). In *17th International Cosmic Ray Conference, Paris*, volume 5, page 50, 1981.

[47] E.W. Hazen, Z.A. Hendel, G.A. Ash, M.J. Foster, L.A. Hodson, R.M. Porter, and M.R. Bull. Measurements of electron densities in E.A.S. using spark chambers and thin scintillators. (Abstract). In *17th International Cosmic Ray Conference, Paris*, volume 6 of *International Cosmic Ray Conference*, page 176, 1981.

[48] M.R. Porter, J.M. Foster, A.L. Hodson, W.E. Hazen, A.Z. Hendel, and R.M. Bull. Air shower density spectrum. In *17th International Cosmic Ray Conference, Paris*, volume 11, pages 417–420, 1981.

[49] W.E.Hazen, A.Z. Hendel, A.G.Ash, J.M. Foster, B.R. Green, A.L. Hodson, M.R. Porter, and R.M. Bull. Subcores in cosmic-ray air showers and high transverse momentum. *Journal of Physics G: Nuclear Physics*, 7(9):1285–1296, 1981.

[50] W.E. Hazen, A.Z. Hendel, J.M. Ash, A.G. Foster, A.L. Hodson, M.R. Porter, and R.M. Bull. Test of high p_t scaling from cosmic-ray interactions up to 400 TeV. *Physical Review Letters*, 48:1562–1564, 1982.

[51] R.M. Bull, A.L. Hodson, and M.R. Porter. A recording system for scintillation counter pulses over a wide dynamic range. In *18th International Cosmic Ray Conference, Bangalore*, volume 9, pages 456–459, 1983.

[52] A.G. Ash and A.L. Hodson. Comparison of simulation results with experimental data on 10^{14}–10^{16} eV air showers. In *18th International Cosmic Ray Conference, Bangalore*, volume 11, pages 205–208, 1983.

[53] A.L. Hodson, M.R. Porter, A.G. Ash, and R.M. Bull. Core flattening in 10^{14}–10^{16} eV air showers. In *18th International Cosmic Ray Conference, Bangalore*, volume 11, pages 201–204, 1983.

[54] A.L. Hodson, A.G. Ash, and R.M. Bull. Particle distributions in $\sim 10^{14}$–10^{16} eV air shower cores at sea level. In *19th International Cosmic Ray Conference, La Jolla*, volume 7, pages 81–84, 1985.

[55] A.L. Hodson, R.M. Bull, R.S. Taylor, and C.H. Belford. Progress report on a new search for free e/3 quarks in the cores of 10^{14}–10^{16} eV air showers. In *19th International Cosmic Ray Conference, La Jolla*, volume 8, pages 306–309, 1985.

[56] P.D. Acton, A.G. Ash, R.M. Bull, and A.L. Hodson. The hadron component within a few metres of the axes of 10^{14}–10^{16} eV air showers. In *20th International Cosmic Ray Conference, Moscow*, volume 6, pages 51–53, 1987.

[57] A.G. Ash, R.M. Bull, A.L. Hodson, and R.S. Taylor. A trigger circuit for selecting air shower cores of 10^{14}–10^{16} eV primary energy, using particle-density ratios. In *20th International Cosmic Ray Conference, Moscow*, volume 6, pages 462–465, 1987.

[58] C.H. Belford, R.M. Bull, A.L. Hodson, and R.S. Taylor. Quark limits in air shower cores. In *20th International Cosmic Ray Conference, Moscow*, volume 6, pages 352–355, 1987.

[59] P. D. Acton, A. G. Ash, A. L. Hodson, and R. M. Bull. The hadron component of 10^{14}–10^{16} eV extensive air showers. In *21st International Cosmic Ray Conference, Adelaide*, volume 9, pages 264–267, 1989.

[60] A.L. Hodson. Reminiscences on experimental work with various particle detectors. *Nuclear Physics B Proceedings Supplements*, 22:178–196, 1991.